Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

THE
AMERICAN ANTHROPOLOGIST

VOL. XI WASHINGTON, D. C., MAY, 1898 No. 5

ENVIRONMENTAL INTERRELATIONS IN ARIZONA[1]

WALTER HOUGH

The plant life of the semi-arid Southwest shows many interesting adaptations to the geographic conditions. One accustomed to seeing the many species of plants here in the East struggling for place, covering the ground with a mat of vegetation, looks with surprise on the vast, red plains of Arizona and New Mexico, sparsely dotted with dull-colored, stunted bushes, popularly thrown together under the name of "sagebrush."

In the East, also, the tender, green mantle hides the scars of time, but in the West we see a world naked and in ruins, as though we were transported to a landscape in the moon.

These vast landscapes, bathed in clear air and lighted by the fervid sun, show tints of marvelous beauty, beyond the power of pen and brush to portray. There is a sense of freedom in these broad outlooks which is fascinating, and no doubt this is one of the reasons why those who have once visited this country are impelled to return.

To the geologist the country offers much greater opportunities for study than to the botanist, for all is open and clear—the crumpled leaves of the book of Nature show their edges on the mountain fronts. Often the general geology of the region is apparent for over a hundred miles at a glance. The details of stratification also can be followed by the eye for many miles, while at a distance over the red Jurassic plains the white Cretaceous hills and mesas and the ponderous remnants of the vast, black lava flows are clearly in sight.

---

[1] Published by the permission of the Secretary of the Smithsonian Institution.

In this crumbling and wind-scarped region the plants have put forth their best efforts to keep a foothold against formidable difficulties.

The soil is light and sandy, each grain rounded by wind action. The greater part of the surface is what is known as "lively sand," the sport of the gales. In places where the soil has a greater clayey constituent it is loosened up by the constant efflorescing of the salts known as "alkali," which pushes up curious elevations, suggesting the burrowing of small animals beneath. The abundance of these salts, which in small quantities would be beneficial to plant growth, is a great drawback to farming by artificial irrigation.

It may be said that these conditions are sufficiently rigorous, but when the extreme dryness of the air, the violence of the winds, the elevation of the region, and consequent cool nights, early frosts, and the heat of the sun are taken into consideration it is a matter of surprise that plants exist at all. Added to these are the depredations of range stock and the attacks of insects.

Still, the plants have adapted themselves to the unstable soil and violent winds by a vigorous root growth, strong woody stems, and a dwarfing in height. The desert bushes look like dwarfed trees of the Japanese gardens. They have the appearance of great age, with their gnarled and twisted stems and contorted roots. I collected at Walpi the root of a paryella, uncovered by the wind, which had grown with half a dozen spiral twists, apparently in the effort to keep in the ground.

They have a saying in Arizona that "everything that is not nailed down blows away." The bush clusters hold together and collect the sand, so that each plant stands on a mound, which gradually rises till the plant gives in. In some localities the clumps of grass keep up the struggle till they stand a foot or more above the level of the ground, on a pillar of roots and earth. The feature in which the desert plants show adaptation to the dryness of the climate is in the leaves. They are small, rounded in outline, and fleshy as a rule, following the development of the cactus in regard to water storage.

It is the rarest thing to see a serrated leaf. The leaves are also few and well placed among the rigid twigs, so as not to be bruised by the violent spring gales.

The curious thing about the precipitation of northeastern Arizona is that the rains come too early and too late to be of much use to a large number of the plants. The spring vegetation depends on the moisture produced by the melting of the winter snows, always problematic as to quantity. In the latter part of August thunder showers bring forward the later plants. These showers are also local and variable. On the track of a thunderstorm the succulent plants spring up like magic. The ground is full of seed, and, owing to the capricious course of the storms, perhaps in some stretches several years may elapse before the dormant seeds get a chance to sprout. Along the washes rains falling on the watershed above may furnish moisture, starting the growth of sunflowers and other weeds. Sometimes in favorable years the dry lake beds will be one mass of sunflowers, presenting a remarkable appearance.

Many plants wait for the seasons of moisture, but the hardy greasewood, artemisia, rhus, and other desert plants seem not to be affected by good fortune or adversity.

Moisture also determines the distribution of plants in the arid region. The botanist knows this, as does the archæologist, for the distribution of the ancient as well as the modern Arizonians is a matter of water. Wherever there is a spring or running water, there is the place to look for ruins. Around protected springs and in canyons where there is perennial water the botanist often reaps a rich harvest of plants. In such a canyon known to the writer there is a series of plants which are puzzling, not being found anywhere else in the region. It is as though these plants were the only survivors of the vicissitudes which have extirpated all their companions less favorably protected.

The location of individuals of a certain species has a profound effect in the modification of the classific characters. For example, it has been noticed that, owing to the favorable or non-favorable habitat of *Eriogonum microthecum*, the plant varies from the corymbosum type to the effusum type. Quite a number of other plants show variation according to well-being, and cause botanists no end of vexation.

Rivers and streams distribute plants along their flood plains where often the same species range the whole length of the stream. This was noticed on the Rio Grande above El Paso, where familiar species which had been collected at Albuquerque were prevalent. A line as sharp as can be imagined divides these plants from those on the sandy bluffs where the character of vegetation is utterly distinct, being that of southern Arizona, yucca palms, cacti, palo verde, mezquite, etc. This change taking place within a few feet is very striking. There is a distribution according to elevation likewise, which need only be mentioned. On the plains the plants have a local distribution in patches of the same species: here a patch of lycium with its red berries, there artemisia or yucca. If the botanist passes a plant with the expectation of finding others later on, he is likely to regret it, for it is probable he may never come across the plant again.

In connection with this local distribution it may be observed that certain plants have adapted themselves to certain soils, some living in places crusted with salt and alkali, others preferring clay, sand, or gravel. The local distribution is perhaps in part due to seeding.

Like the plants of the Arctic, many of the plants of the arid region, when the proper moment occurs, spring up, bloom, and seed in a short time, and disappear under the ministration of that great distributor of Arizona—the wind. Thus, undoubtedly, great areas are seeded, leaving the soil rich in unborn germs. Many plants have devices for wind distribution which, it must be said, seem needless in Arizona.

The bane of the botanist and the Indian herb-gatherer, although the latter has never said so in my hearing, are the depredations of sheep and cattle, which seek out and devour every edible green thing, rendering botanizing difficult, and perhaps extinguishing certain species. Against these the experienced desert plants have thorns, spiny twigs, and unpleasant juices.

The relation of insects and small mammals to plants in the arid country is very close. Each clump is a veritable menagerie, the insects in the branches and beetles digging around at the base, and the mice and spermophles in their burrows under the roots all get shade, protection, and food from the long-suffering plants, and all are mutually helpful in this enforced companionship. The Indians have recognized this relationship, and have assigned certain plants to certain insects or animals which affiliate, as "the caterpillar his corn," "the mole his corn."[1]

Another observation, before we turn to the medicinal plants, is in reference to a curious way in which plants are useful to the dwellers of the arid region. The "ironwood" or palo blanco must send its roots to water. Hence the presence of this shrub has in many cases led to the discovery of springs. The ancient spring of Kintiel, long buried in the sands, was relocated by the growth of palo blanco.

The struggle for existence has thus developed in the desert plants characters which have rendered them useful to the Indian herb doctor. The medicinal properties which long centuries of bitter experience have taught the plants to elaborate for protection against their enemies are known to the Indian, who has put them to the test and ascertained their uses.

Curiously enough, every Moki is a botanist; not a botanist, of course, in the scientific way; one for practical purposes, rather, who had given descriptive names to his plants long before Linnæus had dressed them out in high-sounding Latin.

In the desert Nature has been a good schoolmaster. The Moki sought companionship with the plants and animals as they sought companionship with him. By this is meant that they settled in his fields, drank the water which he developed, and hence have seemed to seek and to depend upon him; so, though the freebooting crows forever lurk around with little fear, and the no less voracious insects prey on the weeds and crops indiscriminately, all have to pay tithes.

The many-hued arid land is poor in life, but such as exists the Moki puts to his own uses. It would seem that the spontaneous crops of Nature's sowing are as valuable and necessary to him as the harvest from his fields. Often, indeed, in past generations when the fields have failed, the wild plants kept his soul and body together. So close is the Hopi engrafted into his environment that there is almost no plant which he does not use in some way and no plant to which he has not given a name. It seems to be part of the education of children to familiarize them with the uses of plants, and to the knowledge of the writer this education begins early; the small children, if they can be induced to overcome their modesty, can usually give the names offhand.

---

[1] See W J McGee, The Beginning of Agriculture, Am. Anthrop., Oct., 1895, and The Beginning of Zooculture, Am. Authrop., July, 1897.

But the uses of plants for food, fire, house-building, basket-making, and other practical purposes are less important to the Moki, after all, than their uses in medicine and religion. By far the larger number of plants of the region fall into these classes, after those used for food, according to the Moki way of thinking. The Moki can no more keep house without sundry nondescript parcels of dried herbs than can an old Virginia negro, and the possession of a rare medicinal plant is sure to bring some advantage to the owner. Oftentimes there is a single place where a certain plant can be found, and this knowledge is power. Any berries growing within a radius of many miles around the pueblos are pretty certain to be sought out and picked, while absurdly long journeys are taken for favored herbs or other useful vegetable substances.

Toby, the inquisitive Tewan, was asked one day where he got the dye for his moccasins. He answered: "You know Flagstaff? Well, way farther across the mountains, at 'Apache House,' get bark from tree; use 'em to make *tochi* red." This means a journey of four hundred miles to get the bark of a birch tree (*Betula occidentalis* ? Hook.).

These journeys are common, for the Moki is no stay-at-home, but roams far beyond the widest view from the high vantage ground of his village, visiting the former seats of his people of by-gone centuries. Thus he knows the flora and fauna over a wide region, and is as much at home in the White mountains as on the Great Colorado. In former times he may have journeyed to the Gulf of California for precious sea-shells, to be used as ornaments and for ceremonial trappings, or made long quests for the much-prized turquois, just as he now goes to the Coconino canyon for baskets or deerskins. His face is familiar at Zuñi, where he fares often on a neighborly visit.

Almost every one, even children, as stated, know the names of plants, but a chosen few are learned in the mysteries of medicine. These are like the "medicine men" of so many tribes. There is, however, no such well defined office and profession of medicine man among the Mokis as has been noticed among other tribes. Perhaps Sálako, mother of the Snake Priest and herself hereditary Snake Woman, is the chief medicine woman in Tusayan. She is indeed a remarkable character, and no one is better versed in spells and herbs than she. No one knows the secrets of mixing the medicine used in the ceremonies but Sálako, and her services are in request at times in all the seven towns of Tusayan.

From Sálako and her son Kopele much of the information in regard to the plants used by the Moki was obtained. The Moki have a theory and practice of medicine. The former, with its spiritual or animistic reasoning, may be wrong, but the practice has secured some beneficial results by experiment, and, as Professor Mason says, those experimented upon are either cured or killed.

The word medicine as applied by the Moki and other tribes is very comprehensive, including charms to influence gods, men, and animals or to cure a stomach ache. As stated, from experiments with the plants some have been discovered which are uniform in action and which would have place in a standard pharmacopœia. Thus there are heating plasters, powders for dressing wounds, emetics, diuretics, purges, sudorific infusions, etc. Other plants are of doubtful value, and in their use other animistic ideas may enter, though some of them, such as those infused for colds, headache, rheumatism, fever, etc., may have therapeutic properties. The obligation of the civilized to the uncivilized for healing plants is very great. Another class is clearly out of the domain of empirical medicine. Tea made from the thistle is a remedy for prickling pains in the larynx, milkweed will induce a flow of milk, and there are other examples of inferential medicine. Perhaps another class is shown by the employment of the plant named for the bat, in order to induce sleep in the daytime.

It may be interesting to look into the workings of the Indian mind as shown by his explanation of the uses of certain of these plants.

A beautiful scarlet gilia (*Gilia aggregata* Spreng) grows on the talus of the giant mesa on which ancient Awatobi stood. This is the only locality where the plant has been collected in this region, but it grows in profusion on the White mountains, 125 miles southeast.

The herdsman of our party was asked the name and use of the plant. He replied: "It is the *pala katchi*, or red male flower, and it is very good for catching antelope. Before going out to kill antelope, hunters rub up the flowers and leaves of the plant and mix them with the meal which they offer during their prayer to the gods of the chase."

"Why is that?" was asked.

"Because," he replied, "the antelope is very fond of this plant and eats it greedily when he can find it." (Animistic idea.)

Another creeping plant (*Solanum triflorum* Nutt.), which bears numerous green fruit about the size of a cherry, filled with small seeds, is called *cavayo ngahu*, or watermelon medicine. The plant may be likened to a miniature watermelon vine. It was explained that if one took the fruit and planted it in the same hill with the watermelon seeds, there would be many watermelons—that is, the watermelon would be influenced to become as prolific as the small plant.

Every one is familiar with the clematis bearing fluffy bunches of seeds having long, hair-like appendages. An Indian lecturing on a collected specimen of the clematis said: "This is very good to make the hair grow. You make a tea of it and rub it on the head, and pretty quick your hair will hang down to your hips," indicating by a gesture the extraordinary length. For the same reason the fallugia is a good hair tonic.

Those plants used in religious ceremonies involve other ideas and theories, such as the sexes of plants, their names, their assignment to the points of the compass, and to the animistic gods, etc. Much work remains to be done on these questions and much remains to be learned on the theory and practice of medicine by the Indian tribes.

Such parts of the summers of 1896–'97 as were spent in Tusayan by the writer in company with Dr J. Walter Fewkes were devoted to the ethnobotany of the Moki. The native names of the plants were ascertained and the uses to which they are put, as far as possible, and much interesting material was gathered, both to the botanist and ethnologist.

The collection forms part of the National Herbarium, and the determinations were kindly made by Mr F. Y. Coville, Dr J. N. Rose and Mr Charles Louis Pollard, of the National Museum. A number of plants were added to the list published in THE

American Anthropologist for February, 1897, and much new and interesting information was secured. It is hoped during the coming season to ascertain the familiarity of the Moki with the plants of the White mountains and the Mogollons to the south on the line of the ancient migration of some of the clans. There is good reason to believe that the Mokis know these plants which surrounded their former habitats; and it is probable that data of considerable importance may be collected.

The Hopi are practically vegetarians. There is necessarily a scarcity of animal life in the desert. Sporadically wild game appears in their dietary in the shape of an occasional rabbit, prairie dog, or rat. The annual rabbit hunt of the Flute fraternity last summer, in which 25 horsemen and numerous footmen beat over a number of square miles of country, produced one specimen. Occasionally a sheep or goat, meat bought of the Navaho, or a burro varies the menu of the Pueblo.

There is quite a contrast between the vegetarian Hopi and the meat-eating tribes like the Apache and Navaho, and the contrast extends to physique and character, to roving and sedentary life, to agriculture and hunting, and to skill in the arts. This also points to the distinct origin of the Hopi under more favorable culture.

If the Sun is the father of the Hopi, then Corn is their mother. The Ceylonese are said to know sixty ways of cooking rice; the Hopi seem to have as many for corn. There are many interesting matters connected with the cultivation and uses of corn which cannot be entered into here. A sidelight on the frugality and farsightedness of the Hopi is shown by their storage of a reserve supply of corn for two years.

This leads to the observation that the food plants useful to the Hopi are (1) plants under cultivation, both native and acquired, and (2) plants the usufruct of nature. The Hopi brought from their priscan home corn, beans, melons, squash, cotton, and some garden plants. They have acquired peaches, apricots, wheat, and a number of other plants which they infrequently cultivate.[1] Of peaches they are extravagantly fond, and every village has orchards. As the crop failed last year, one of our Indian workmen at Winslow invested all his earnings in peaches, which he would have to carry 80 miles north to his native village. The apricot, of which I saw but a few trees, does not bear, probably from the lack of a fertilizing insect. Very little wheat is raised and that by the Oraibi, at their agricultural summer village of Moenkopi, where cotton also is grown.

---

[1] The Hopi plant corn, watermelons, muskmelons, onions, beans, gourds, chili, sunflowers, squashes, wheat, sorghum, tomatoes, potatoes, cotton, grapes, pumpkins, garlic, coxcomb, coriander, saffron, tobacco, peaches, apricots, and nectarines. They will try any seed that is given them, and among their numerous requests the demand for seed is prominent.

These plants fall under a number of classes, according to their uses for food, architecture, dress and adornment, domestic life, domestic arts, agriculture, medicine (as folk medicine and empirical medicine), religion, and folk-lore.

Food

Kwákwi, Sporobolus cryptandrus strictus Scribn. Seeds ground with corn to make a kind of cake greatly enjoyed by the Hopi.

Shíbna, Astragalus pictus filifolius Gray. Roots eaten for food.

Tüíchima, Pectis angustifolia Torrey. Much sought after and enjoyed boiled with green corn (shammi). The Zuñi also eat it.

Tümi, Cleome integrifolia T. & G. Leaves boiled with green corn.

Tümininġiwa, Chamæsaracha coronopus Gray. Berries are eaten.

Wiwa, Acanthochiton Wrightii Torr. Cooked as greens with meat. It is known as the "ancient Hopi food," and is gathered and strung in long bunches, which hang in nearly every house. The Hopi recount that this plant has warded off famine a number of times, springing up as it does before the corn is filled.

Worshtusha, Panicum obtusum H. B. K. Seeds eaten ground with corn.

Üñátki, Atriplex argenteum Nutt. The salty leaves are boiled with fat and eaten; "very sweet." This is the earliest spring plant used for food (Fewkes).

Katókia, Dicoria Brandegii Gray. Flowers and seeds ground up and eaten.

Kōtóki, Chenopodium cornutum B. & H. Seeds and flowers eaten, the former ground and mixed with meal to make dumplings wrapped in corn-husk and called somipiki.

Kébi, Lycium pallidum Miers. The berries, which are much desired, are eaten raw or are dried for winter use.

Küsüñ'a, Parosela lanata (Spreng). The roots are wholesome for food. They are scraped and eaten raw as a sweet.

Lakápa (probably Spanish), Phoradendron juniperinum Engelm. Used as a substitute for coffee.

Léhü, Eriocoma membranacea (Pursh) Beal. Seeds used in ancient times for food.

Mashiláshi, Solidago missouriensis Nutt. The young leaves are eaten with salt.

Müúñtoshaba, Poliomintha incana Gray. The leaves are boiled and eaten; the flowers are rubbed up and used as a flavor, which the Hopi say "tastes like brown sugar." The Mentha canadensis is also eaten as a relish.

Nünü, Sporobolus cryptandrus flexuosus Thurb. Seeds used for food.

Pátañwuba, Reverchonia arenaria Gray. The berries are sweet and wholesome.

Hano kusunga, Spiesia Lambertii (Pursh) Kuntze. The roots are eaten by the Tewans of Hano, hence the name. The Oraibi people call the plant shetañwa, and the Walpi informant of 1896 called the plant taie′ñwei. Some variation in the names among the villagers is thus shown.

Pasomi, Tradescantia virginiana L. The vast range which this species covers is remarkable. Botanists have not found enough difference between the Tradescantia of Arizona and those of Virginia to erect even a variety. The plant is greatly prized by the Hopi for food. It is customary to cook it as greens.

Sübi, Rhus trilobata Nutt. The berries are eaten.

Quivi, Stanleya, integrifolia James. The leaves are generally eaten as a relish, and as greens.

Yowipshi, Ribes cereum Dougl. Great numbers of these gooseberry bushes grow on the talus of the mesa near the spring called Wipo, where the Indians go to gather the berries.

Uápshi, Physalis longifolia Nutt. The Hopi ate the fruit in old times. The Zunis dry the fruit, grind it, and make bread with the meal.

Tüvü, Pinus monophylla Torr. & Frem. Piñon nuts are gathered and eaten.

Tüwxbi, Amelanchier pallida Greene. This shrub is found in watered canyons and near springs. The berries are much sought after.

Piháia, Portulaca retusa Engelm.? Plant eaten by Hopi.

Tü′mna, Solanum Jamesii Torr. The wild potato. The tubers are gathered, mixed with clay, and eaten.

Only two narcotics are known to the Hopi, one being Píba, or tobacco, the two species gathered being Nicotiana trigonophylla Dunal and the N. attenuata Torr., and the other Shemóna, Datura metaloides DC. The use of the latter is extremely rare and is much decried by the Hopi.

Two plants are chewed in the way of chewing gum, Kopóna, Sphæralcea angustifolia Spach, and Poáwi, Eriogonum corymbosum, Benth., the mucilaginous stems of which are employed.

Ishü, Stanleya albescens Jones. The leaves are boiled and eaten in the spring.

Pasípna, Astragalus pictus filifolius Gray. The roots are eaten raw as a sweet.

Yün′yü, Opuntia. The stem is boiled and eaten in the spring when food is scarce.

Samóa, Yucca baccata Torr. The fruit is eaten.

Hési, Calochortus aureus Watson. The root is eaten raw.

Sü'rswa, Chenopodium album L. The leaves are boiled and eaten with fat.

Posiüh, Amaranthus blitoides Watson. The seeds were formerly used as food.

Nanákopsi, Monarda citriodora Cerv. This plant is boiled and eaten only with hares.

Mü'ha, Lygodesmia grandiflora T. & G. The leaves are boiled with meat.

Lüktánkya, Artemisia dracunculoides Pursh. "In the early spring the leaves are gathered and brought home, baked between hot stones, and eaten after dipping in salted water" (Fewkes).

Kuranto, (Spanish), Coriandrum sativum L. The plant is dipped in stew and eaten as a condiment.

Sále, Mentzelia albicaulis Dougl. Seeds are parched and ground; it is eaten in pinches from the wicker tray in which it is served (Fewkes).

Hoyávako, Atriplex confertifolium Watson. Its scented leaves are boiled in the water used to mix corn pudding.

House-building

Wórshi, Muhlenbergia pungens Thurb. Bunches of this grass are used in the upper layer over the kahabi brush in the roofs of houses.

Kahábi, Salix nigra Wrightii Anders. Brush from this shrub used as the first layer in the ceiling and roof. There are three kinds of Kahabi, known as green, gray, and red, according to the color of the stems. The variety collected is called Shaqua Kahabi, or green Kahabi.

Pashihürpbe. Populus deltoides Marsh. For roof beams. The most valuable tree known to the Hopi, by whom it is planted.

Móhu Yucca glauca Nutt. Woven to make hoods for fireplaces.

Games and Amusements

Patóki, Astragalus megacarpus Parryi Gray. The beautiful pods mottled rose and green and plump with the contained air catch the children's eye. They gather the pods and pop them, each striving to outdo the other in the loudness of the report.

Maĭĭbĭ, Choudraphora Douglasii stenophylla (Gray). The stems of this plant, gathered together into a bundle and tied with string, form the targets at which small boys shoot their arrows.

Dress and Adornment

Hóko, Juniperus occidentalis Hook. The seeds are pierced and strung as beads. The ancient graves yield examples.

Avátsi, Pentstemon ambiguus Torr. The flower is worn for adornment.

Ishákana, Verbesina enceloides B. & H. Flower worn by children in the hair on the forehead.

Wórshi, Muhlenbergia pungens Thurb. The flower stem is used for hair-brushes.

Wupámansi, Castilleja linariæfolia Benth. The flowers are worn for adornment by the girls. The name means "the great girl flower." It is one of the very few attractive and beautiful flowers of this region and may be appropriately called the Hopi national flower.

...., Solanum elæagnifolium Cav. The yellow seed apples of this plant are often strung for necklaces. Major J. W. Powell collected a necklace like those described which is "worn in dancing." The Moki name for the necklace is Choo kú-h ah kah wé. The specimen is now in the U. S. National Museum; catalogue number, 22873.

Domestic Life

Hanoshivápi, Chrysothannus graveolens (Nutt) Greene. So named because the Tewans of the pueblo of Hano carry great bundles for firewood.

Hóko, Juniperus occidentalis Hook. Called "arrow wood." The principal firewood; from the bark the slow match is prepared.

Kotókshiluvi, Parryella filifolia T. & G. The twigs of this plant are used for snow brooms.

Tü′vü, Pinus monophylla Torr. & Frem. Excellent firewood. The gum is used for chewing and in the arts.

Móhu, Yucca glauca Nutt. The root is used for soap, notably for washing the hair in religious ceremonies.

Topílchi, Humulus lupulus L. Wild hops are used to make yeast, according to Mongwe.

The shells of gourds are much prized for dippers, funnels, and other vessels.

Towü′vapi, Boerhavia erecta L. The plant, which possesses sticky leaves and stems, is sometimes hung in the houses to catch flies.

Samóa, Yucca baccata Torr. The root is used for soap.

Müyitka, Senecio douglasii DC. The top of this plant is used as a brush to remove the hair spines from prickly-pears.

Arts

Sü′ovi, Atriplex canescens James. The ashes of this plant are used to give a gray color to piké.

Kómo, Amaranthus sp. Cultivated in terrace gardens around the springs and used for dyeing piké red.

Komótoshu, Amaranthus Palmeri Watson (?). From the seeds a red dye is prepared for Kachina piké, a paper bread consumed during the Kachina dances.

Oháishi, Thelesperma gracile T. & G. The whole plant is used to make red-brown dye for basket splints.

Paláchpü, Betula occidentalis Hook. (?) The bark is used by the Hopi for dyeing buckskin red-brown for moccasins and other purposes. The Navaho also use the bark of a birch, which they call Kish, for dyeing leather. The Hopi procure the bark at "Apache House," south of the San Francisco mountains.

Ákàüshi, Helianthus petiolaris Nutt. The blue dye which the Hopi impart to their blankets is prepared from the seeds of the sunflower.

Ása, Sisymbrium canescens Nutt. The seeds of this plant are ground up in a stone mortar, forming an oily liquid, which serves as a medium for the iron paint used in pottery decoration.

Móhu, Yucca glauca Nutt. This plant has many uses in the arts for basketry, paint brushes, tying material, etc.

Kotókshiluvi, Parryella filifolia T. & G. The ashes of this plant are used to color piké.

Tü vü, Pinus monophylla Torr. & Frem. The gum was used as cement in the ancient turquois mosaics as it is in the modern. A few specimens of pottery made by Nampio are glazed with piñon gum.

Shemótala, Calamovilfa longifolia (Hook.) Hack. The long canes are neatly twined into the ceremonial wedding-blanket covers.

Pieces of gourd are made into smoothers for pottery.

Cübi, Rhus trilobata Nutt. The twigs are used for coarse basketry.

Samóa, Yucca baccata Torr. The root is used for soap and the leaves for basketry.

Tákashü, Hilaria Jamesii Benth. The grass used by women in making the coiled baskets.

Asapzrani (Spanish), Carthamus tinctorius Linn. Saffron, used to dye piké yellow.

Agriculture and Forage

Harü'si, Bouteloua oligostachya (Nutt.) Torr. Forage grass for animals.

Pawia, Franseria Hookeri Nutt. Food for sheep.

Poshíotosü, Amaranthus blitoides Watson. Also eaten by sheep.

Tahoyókpi, Chenopodium olidum Watson. Also eaten by sheep.

Kwákwi, Sporobolus cryptandrus strictus Scribn. Fine forage grass.

Sü'obi, Atriplex canescens (Pursh) James. Eaten by horses.

Takáshü, Hilaria Jamesii (Torr.) Benth. Good grass for horses.

Tavótka, Eurotia lanata Moq. Horses like it very much. The twigs are eaten by them in winter.

Pĕzrü, Aristida purpurea Nutt. Bad forage for animals on account of the awns. The same name is applied to Polypogon littoralis Smith, a grass which is rarely seen.

Kwavü'tushü, Munroa squarrosa Torr. This grass is covered with fine down, which causes horses to cough and choke when they attempt to eat it.

Taiíñwei, Spiesia Lambertii (Pursh) Kuntze. This is the "loco weed," so injurious to horses.

Homítskapü, Cryptanthe sp. The evil burs get into wool and in many ways are troublesome to man and beast.

Brush from a number of plants is employed in the cultivated fields for windbreaks or sand sheds. Brush is also placed in gullies to prevent washing, and brush dams are made to form level places by the collection of the sediment. Crops are planted on the deltas so formed.

Pákabi, Phragmites Phragmites (L.) Karst. The name of this reed-like grass sounds like a Mexican word. It grows near Wipo, a fine spring four miles from Walpi. Horses eat this grass.

Patü'saka, Panicum autumnale Bosc. and Panicularia nervata (Willd) Kuntze. The name is applied to both species, which in some seasons are abundant and useful for forage.

MEDICINE

Chacháume, Townsendia Arizonica Gray. Women boil the plant to make tea to induce pregnancy.

Chiuíña, Astragalus mollissimus Torr. Said to be a good medicine for headache; the leaves are bruised and rubbed on the temples.

Tahoóvapi, Gaura parviflora Dougl. Tea made from the root for snake bite.

Tüwázhriapi, Ranunculus cymbalaria Pursh. Known by the Hopi as "Navaho medicine."

Wütákpala (no specimen). Rubbed on the breast or legs for pain.

Ishákana, Verbesina enceloides B. & H. Used on boils or for skin diseases.

Kawíkana, Croton Texensis Muell. Taken as an emetic to relieve the stomach.

Koicháña, Allionia linearis Pursh. Boiled to make an infusion for wounds.

Kokyáña, Brickellia Wrightii Gray. Called "Navaho tea."

Lakápa (Spanish), Phoradendron juniperinum Engelm. The Navaho and Hopi make a beverage, which they say is like coffee, from this mistletoe. A large species on the cottonwood tree, called "lo mápi," is used as medicine.

Koükatchi, Gilia longiflora Don. "Male flower." The leaves are boiled for stomach ache.

Aningáhu, Gilia multiflora Nutt. Called "ant medicine," the bruised leaves being thought a specific when rubbed on ant bites. The plant was collected 40 miles south of Walpi on the 6,000-foot contour.

Köchib'si, Oreocarya suffruticosa (Torr.) Greene (Krynitzkia Jamesii Gray). Pounded up and used for pains in the body. Perhaps the prickly character of the plant may have something to do with the use.

Chiúiña, Carduus Rothrockii (Gray) Greene. It was explained that this thistle is boiled and drank as tea for colds which give rise to a prickling sensation in the throat.

Topelvachába or *pachába*, Coleosanthus Wrightii (Gray) Britton. Good for headache. The terebinthine-aromatic leaves are bruised and rubbed on.

Monáhaña, Artemisia Canadensis Michx. Rubbed up and placed on the temples for headache.

Erigeron Canadensis Linn. was named monáhaña by my informant of last year. The Artemisia was probably mistaken by Kopele, my informant of 1896, for the Erigeron, as the former is quite diffuse in its habit, and it seems necessary to separate it from Artemisia Canadensis.

Mấiĕtka, Senecio Douglasii DC. Rubbed on the limbs for rheumatism and soreness of the muscles.

Mamánti, Aster sp. Tea is made from the flower and given to young girls to make them fruitful.

Maĭ́ĭbĭ, Chrysothamnus depressus Nutt. This plant grows on the Awatobi mesa. The common plant of this name is C. douglasii stenophylla Gray, of which an infusion is made for bathing bruises and wounds.

Iavótka, Eurotia lanata Moq. One of the ingredients of tea for fever.

Tawázhriapi, Linum rigidum Pursh. Taken as tea for stomach disorder. This herb is also called Sikyashi, meaning "yellow flower."

Tüpeloválchu, Chrysopsis villosa Nutt. Pain in the chest cured by a tea made from the leaves and flowers.

Wéi, Aplopappus sp. The root is boiled to make a tea for cough.

Ohấ'ishi, Thelesperma gracile T. & G. Tea for headache is made from this plant.

Poấhi, Erigonum corymbosum Benth. (?). Infusion made and drank by women to expedite child-birth.

E. microthecum Nutt. has apparently the same name and use. No explanation as to why the plant is used for the purpose was secured. The ease with which the plant sheds its abundant flowers may have given rise to the idea.

Poấushi, Eriogonum aureum Jones var. This plant has a similar use to those just given.

Pámnavi, Gutierrezia sarothræ (Pursh) Britt. & Rusby. Tea for fever is made from this plant, in combination with three other plants.

Páláñi (no specimen). The plant grows at Awatobi, where the roots are gathered to make tea for colds.

Kütsibsü, Biscutella wislizeni B. & H. The leaf is dried, rubbed to a powder, and sprinkled on wounds.

Sübi, Rhus trilobata Nutt. The buds are regarded as medicinal.

Napalü'ña, Artemisia tridentata Nutt. "An infusion of the leaves is drank by a person whose ailment is supposed to be in the ilium."

Pĭñá, Asclepias verticillata L. An infusion is drank to increase the flow of milk.

A. mexicana Cav., which grows around the water holes on the top of the Sikyatki mesa, has a similar use. The name refers to any plant which, upon being broken, yields milky juice. The medicinal effect is inferential.

Kocháshi (*Piĭñá*), Polygonum ramosissimum Michx. Ground on a stone and used as a plaster; the effect is heating. Women drink a tea infused from the leaves to increase milk.

Kocháshiōa, Polygonum aviculare L. The name means white flower. In this case the Hopi recognize the specific characters of the two polygonums. This plant has the same use as the former.

Püshúa, Epilobium coloratum Linn. Pounded up and rubbed on for pain in the legs.

Shilála, Astragalus Pattersoni Gray. Called "rattle plant" because of the noise made by the dried pods. The leaves are also pounded up and applied to the legs for pain.

Wikiákshopi, Clematis ligusticifolia Nutt. Said to be very good for promoting the growth of the hair.

Hünibi, Fallugia paradoxa Endl. An infusion of the plant is said to be a good hair tonic. The feathers or hair-like styles may have given rise to this idea in both this plant and the clematis.

Palákatchi, Gilia aggregata Spreng. The name means "red male flower." The flowers are ground with meal for the hunter's petition before setting out on an antelope hunt, because that animal is very fond of this plant. This Gilia was only found on the Awatobi mesa by the collector. It is abundant in the White mountains.

Cavalloñáhu, Solanum triflorum Nutt. The fruit is pulped and the seeds are planted in the watermelon hills "to make many melons." The plant resembles a miniature watermelon vine.

RELIGION

Shĕmótala, Calamovilfa longifolia (Hook.) Hack. Carried in the Humis Kachina.

Chuóshi, Aster sp. Mixed with sacred tobacco.

Maíbĭ, Chrysothamnus douglasii stenophylla Gray. A compnent of the Shaqua paho.

Tüminala, Martynia louisiana Mill. Part of the soyalana paho; plant male.

Hovápi, Artemisia tridentata Nutt. Used in the flute paho.

Pámnavi, Gutierrezia Sarothrac (Pursh) Brit. & Rusby. Used in the snake paho.

Tewi, Sarcobatus vermiculatus Torr. One of the four sacred kiva fuels.

Pashehürp′bi, Populus deltoides Marsh. The peeled shoots are used in preparing the pahos or prayer-sticks for all ceremonies. Tihus, parts of masks, fire-sticks, plume boxes, etc., are carved from the wood.

Hohoyána, Physaria Newberryi Gray. "This plant is one of the ingredients of the snake charm or antidote drank after the Snake dance by all who have taken part as snake priests" (Fewkes).

Sorósi, Delphinium scaposum Greene. Flowers are ground with corn to make blue meal, "blue pollen," for the flute altar.

Cübi, Rhus trilobata Nutt. Twigs used for ceremonial purposes; the branches are one of the four ceremonial kiva fuels.

Póna, Equisetum lævigatum Braun. Dried and ground with corn to make the sacred bread called ponoviki.

Hési, Calochortus aureus Watson. The flowers and seeds are ground with meal to make yellow pollen for the flute ceremony.

Kü'iña, Artemisia frigida Willd. Used in pahos.

Süóvi, Atriplex canescens James. One of the four kiva fuels.

Sivwápi, Bigelovia Howardi Gray. The dried plant is one of the four kiva fuels. "An infusion of the flowers is used to color a chalky stone employed as a personal decoration during ceremonies" (Fewkes).

Kivi, Lycium pallidum Miers. The entire shrub is used in the Niman Katcina.

Pi'ba, Nicotiana attenuata Torr. Smoked on all ceremonial occasions.

Cotton is cultivated almost exclusively for ceremonial purposes, its chief consumption being for the string employed in assembling the elements of the pahos.

Kahábi, Salix nigra Wrightii Anders. Katcinas wear twigs of this willow on the wrist.

Mántoko, Gaura suffulta Engelm. This plant is a component of the flute paho.

FOLK-LORE

Kolnákawa, Erigonum thomasii Torr. The big rat, Kalna, eats this plant; hence its name.

Pámnavi, Gutierrezia sarothræ (Pursh) Britton & Rusby. This plant, which grows with the mäíbí, Bigelovia douglasii stenophylla Gray, is called the child of the mäíbí.

Pi'iñá, Polygonum ramosissimum Michx. This plant exudes a milky substance when broken, and hence is used to increase a scanty flow of milk in nursing mothers.

Powü'üsi, Abronia micrantha (Torr.) Choisy, and A. fragrans Nutt. Placed on a child's head to induce sleep.

Sóayañ'a, Alliona nyctaginea Michx. (Oxybaphus nyctagineus Sweet). This plant is named for the bat. When babies will not sleep in the daytime they are washed in a decoction of this plant, because the bat sleeps during the day.

Tüminala, Martynia louisiana Mill. The plant is male; gender of plants.

Hohoyáña, Physaria newberryi Gray. Named from the Asida rimata or prayer beetle and nahu charm.

Ása, Sisymbrium canescens Nutt. One Hopi clan bears the name of this plant. (See legend given by Dr Fewkes in *The American Anthropologist* for January, 1896, p. 15.)

Léhü, Oryzopsis cuspidata Benth. Also the name of one of the clans.

Máryitka, Senecio douglasii DC. The name means "mole corn." "Many plants are thus assigned to animals supposed to hold them in special favor" (Fewkes).

The following summary, in which the duplications have not been eliminated, gives the number of plants falling into the general classes. As there are probably not over 160 indigenous species in the environment, this list shows the thorough way in which the Hopi have made use of their plant surroundings.

Agriculture and forage (not cultivated)	13
Arts	17
Architecture	4
Domestic life	10
Games and amusements	2
Dress and adornment	6
Folk-lore	10
Food	47
Medicine, folk and empirical	45
Religion	19
	173

Comparatively late in the study of the new science of ethnology has attention been called to the preëminent importance of the environments of tribes. The idea has been known for centuries; the scientific renaissance brought it into prominence along with more careful methods of observation and more accurate division of the field into special subjects for observation.

While tribes have been modified by environment and by changes in environment, too much, perhaps, has been attributed to it, from incompleteness and lack of observation.

Years ago some writer propounded a theory for the various complexions of the human race, explaining that men became lighter in proportion to their distance from the equator. Buckle produced also many similar delusive generalizations, giving too much influence to material surroundings and too little to the genius and brain of man.

Without doubt, in the coming years a sufficient body of conscientiously observed facts will be collected from which generalizations may be deduced. There are, no doubt, subtle influences due to life in the desert, the plain, the mountains, and the seashore and islands, ease or difficulty of intercourse, which modify peoples. It is well understood that there is a relation between environment and health, and that the struggle for subsistence makes or unmakes peoples.

The Hopi are one of the most interesting of the North American tribes. Their long isolation from geographical conditions has kept them unmodified by the influences which have changed most native tribes. In the last few years the wedge of civilization has entered, however, and before long it will be too late to make the studies which are so desirable and of so much importance to the science of ethnology. It is earnestly hoped that the Hopi may be thoroughly studied in regard to their natural environment, ceremonials, and arts as speedily as possible.

SYSTEMATIC LIST OF SPECIES.

Lichenes:
  Specimen of orange lichen which grows on rocks; called by the Hopi owáshi, "rock flower."

Equisetaceae:
  Equisetum laevigatum Braun.

Coniferae:
  Juniperus occidentalis Hook.
  Pinus monophylla Torr. & Frem.

Gramineae:
  Muhlenbergia pungens Thurb.
  Boutelona oligostachya (Nutt.) Torr.
  Phragmites phragmites (L.) Karst.
  Panicularia nervata (Willd.) Kuntze (Glyceria nervata Trin.).
  Munroa squarrosa Torr.
  Calamovilfa longifolia (Hook.) Hack.
  Hilaria Jamesii Benth.
  Panicum obtusum H B K.
    autumnale Bosc.
  Aristida purpurea Nutt.
  Oryzopsis cuspidata Benth.
  Polypogon littoralis Smith.
  Sporobolus cryptandrus strictus Scribn.
    flexuosus Thurb.

Commelinaceae:
  Tradescantia Virginiana L.

Liliaceae:
  Yucca baccata Torr.
    glauca Nutt.
  Calochortus aureus Watson.

Salicineae:
  Salix nigra Wrightii Anders.
  Populus deltoides Marsh.

Betulaceae:
- Betula occidentalis Hook (?)

Loranthaceae:
- Phoradendron juniperinum Engelm.

Urticaceae:
- Humulus lupulus L.

Polygonaceae:
- Eriogonum microthecum Nutt.
  - corymbosum Benth.
  - Thomasii Torr.
- Polygonum ramosissimum Michx.

Chenopodiaceae:
- Sarcobatus vermiculatus Torr.
- Chenopodium cornutum B. & H.
  - album L.
  - olidum Wats.
- Atriplex argenteum Nutt.
  - canescens James.
  - confertifolium Wats.
- Eurotia lanata Moq.

Amarantaceae:
- Amaranthus sp.
  - Palmeri Watson (?)
  - blitoides Watson.

Nyctaginaceae:
- Allionia linearis Pursh.
  - nyctaginea Michx
- Abronia micrantha (Torr.) Choisy.
  - fragrans Nutt.
- Boerhavia erecta L.

Portulacaceae:
- Portulaca retusa Eng.

Ranunculaceae:
- Ranunculus cymbalaria Pursh.
- Delphinium scaposum Greene.
- Clematis ligusticifolia Nutt.

Cruciferae:
- Stanleya albescens Jones.
- Stanleya integrifolia James.
- Sisymbrium canescens Nutt.
- Physaria Newberryi Gray.
- Biscutella Wislizeni B. & H.

Capparidaceae:
- Cleome integrifolia T. & G.

Saxifragaceae:
- Ribes cereum Dougl.

Rosaceae:
- Fallugia paradoxa Endl.
- Amelanchier pallida Greene.

Leguminosae:
- Parosela lanata (Spreng) Britton.
- Astragalus mollissimus Torr.
- Astragalus pictus filifolius Gray.
- Astragalus megacarpus Parryi Gray.
- Astragalus Pattersoni Gray.
- Spiesia Lambertii (Pursh) Kuntze. (Oxytropis Lambertii Pursh.)
- Parryella filifolia T. & G.

Linaceae:
- Linum rigidum Pursh.

Euphorbiaceae:
- Croton Texensis Müll.

Anacardiaceae:
- Rhus trilobata Nutt.

Malvaceae:
- Sphæralcea angustifolia Spach.

Loasaceae:
- Mentzelia albicaulis Dougl.

Cactaceae:
- Opuntia sp.

Onagraceae:
- Epilobium coloratum Muhl.
- Gaura parviflora Dougl.
- Gaura suffulta Engelm.

Umbelliferae:
- Coriandrum sativum L.

Asclepiadaceae:
- Asclepias verticillata L.
  - mexicana Cav.

Polemoniaceae:
- Gilia multiflora Nutt.
  - longiflora Don.
  - aggregata Spreng.

Borraginaceae:
- Krynitzkia sp.
- Oreocarya suffruticosa (Torr.) Greene.

Labiatae:
- Poliomintha incana Gray.
- Monarda citriodora Cerv.

Solanaceae :

- Solanum jamesii Torr.
  - elæagnifolium Cav.
  - triflorum Nutt.
- Chamæsaracha coronopus Gray.
- Physalis longifolia Nutt.
- Lycium pallidum Miers.
- Datura meteloides DC.
- Nicotiana attenuata Torr.
  - trigonophylla Duval.

Scrophulariaceae :

- Pentstemon ambiguus Torr.
- Castilleja linariæfolia Benth.

Pedaliaceae :

- Martynia louisiana Mill. (M. proboscidea Glox).

Carduaceae :

- Carthamus tinctorius L.
- Coleosanthus Wrightii (Gray) Britton.
- Brickellia Wrightii Gray.
- Gutierrezia Sarothrae (Pursh) Britt. & Rusby (G. euthamiae T. & G.)
- Chrysopsis villosa Nutt.
- Aplopappus sp.
- Bigelovia graveolens Gray.
  - Douglasii stenophylla Gray.
  - Howardi Gray.
- Chrysothamnus depressus Nutt.
- Solidago missouriensis Nutt.
- Townsendia Arizonica Gray.
- Aster sp.
- Erigeron Canadensis L.
- Dicoria Brandegii Gray.
- Franseria Hookeriana Nutt.
- Helianthus petiolaris Nutt.
- Verbesina encelioides B. & H.
- Thelesperma gracile T. & G.
- Pectis angustifolia Torr.
- Artemisia dracunculoides Pursh.
  - canadensis Michx.
  - tridentata Nutt.
  - frigida Willd.
- Senecio douglasii DC.
- Carduus Rothrockii (Gray) Greene.
- Lygodesmia grandiflora Torr. & Gray.